

## ABSTRACT OF THE DISCLOSURE

A system and method for calculating the lateral velocity of a rotating drilling tool within a borehole, the system comprising: a pair of accelerometers placed oppositely across the drilling tool axis of rotation and two magnetometers. The method comprises:

5 reading tool radial acceleration signals  $a_{r1}$ ,  $a_{r2}$ , and tangential acceleration signals,  $a_{t1}$  and  $a_{t2}$ , obtained with a quadrature accelerometer detection system; reading  $B_x$  and  $B_y$ , the tool's magnetic phase data, from two orthogonally placed magnetometers; determining the rotational phase angle of the drilling tool relative to the earth's gravity field by first

10 determining the tool's magnetic phase, and the phase shift between the tool's magnetic phase and gravity phase; and processing the foregoing data to yield a lateral tool velocity which optionally compensates for the effect of gravity on the accelerometers, or converts the lateral tool velocity from the tool reference frame to the borehole reference frame, or does both.